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418. Proposed by MRS. H. E. TREFETHEN, Waterville, Maine.

The difference of the squares of the two interior diagonals of a cyclic quadrilateral is to twice their rectangle as the distance between their mid-points is to the third diagonal.

419. Proposed by S. LEFSCHETZ, University of Nebraska.

Given a circle and a tangent to it. To find a point on its circumference such that the sum of its distances to the tangent and its point of contact shall be equal to a given length.

(Rouché et de Comberousse: *Géométrie.*)

CALCULUS.

339. Proposed by T. H. GRONWALL, Chicago, Ill.

To show that for any real value of x

$$\left|\frac{d^n}{dx^n}\left(\frac{\sin x}{x}\right)\right| \leqq \frac{1}{n+1}, \qquad \text{and} \qquad \left|\frac{d^n}{dx^n}\left(\frac{1-\cos x}{x}\right)\right| \leqq \frac{1}{n+1}.$$

340. Proposed by C. N. SCHMALL, New York, N. Y.

A pencil of parallel rays of light is incident upon a lens whose faces have the radii r_1, r_2, respectively. Show that the distance of the principal focus from the center of the first face of the lens will be a maximum or a minimum when

$$\frac{r_1}{r_2} = \frac{(\mu-1)^{1/2}}{1+(\mu-1)^{1/2}},$$

where μ has its usual meaning.

341. Proposed by E. B. ESCOTT, University of Michigan.

Find an expression for the volume of a barrel in terms of the length l, the bung diameter a, and the head diameter b, also an approximate expression when a and b are nearly equal.

MECHANICS.

271. Proposed by V. M. SPUNAR, Chicago, Ill.

Find the center of gravity of the volume formed by the revolution around the x-axis of the area of the curve $y^4 - axy^2 + x^4 = 0$.

272. Proposed by W. J. GREENSTREET, Editor Mathematical Gazette, England.

Around a smooth fixed circular pulley is wound a massless inextensible string, and straight portions go to two free ends A and B to which masses are fastened. The mass at A is initially projected perpendicular to the string while the other is initially at rest. The length of the straight portion to the first mass is initially l and subsequently is r. Find the velocity of the second mass at that moment.

NUMBER THEORY AND DIOPHANTINE ANALYSIS.

187. Proposed by L. E. DICKSON, University of Chicago.

Find an amicable number triple by solving one of the equations (other than the last) in the MONTHLY, March, 1913, page 92. Note that a solution a is to be excluded if not prime to the numbers in the same line.

188. Proposed by ARTEMAS MARTIN, Washington, D. C.

Find rational values for v, w and x that will satisfy simultaneously the conditions

$$(m^2+n^2)(v^2+w^2+x^2)^2 - 4m^2n^2v^2 + m^2n^2(m^2+n^2) = 0, \tag{1}$$

$$(m^2+n^2)(v^2+w^2+x^2)^2 - 4m^2n^2w^2 + m^2n^2(m^2+n^2) = 0, \tag{2}$$

$$(m^2+n^2)(v^2+w^2+x^2) - 4m^2n^2x^2 + m^2n^2(m^2+n^2) = 0, \tag{3}$$

m and n being known quantities.

189. Proposed by W. E. HEAL, Washington, D. C.

Develop a formula for the value of x in the equation $p^x + q^x = s^x$, p, q, and s being integral numbers.